nomena of the Mersey, Nene, and Dee. In May 1849 he surveyed the lower portion of the river Nene, in connection with the Admiralty inquiry into the Norfolk Estuary Bill of that year; and in April 1850 he reported to the Admiralty on the proposed Hartlepool West Harbour and Docks.

In 1852 he was at New York engaged in the Croton Aqueduct department. He then went to Spain, and for a considerable time worked under the Spanish Government in the irrigation of the 'Patrimonia Reale.' In 1861, as Admiralty Inspector, he held an inquiry on the proposed Nene Valley Drainage and Navigation Works. In 1864, he went to Turkey, and was employed on the Smyrna and Casaba Railway. His last work was in 1868, when he was requested to report upon the utilisation of the fresh-water supply of the Thorney river, a tributary to the Nene.

In 1877 he had a slight attack of paralysis, from which, however, he quickly recovered. On December 4, 1879, he was stricken with apoplexy in Westminster, and died on the following day.

He was elected a Fellow of this Society on January 10, 1845; he was also a member of the Institute of Civil Engineers.

He was known for the greater part of his life as Mr. John George Cockburn Curtis, the name of Godsman having been assumed by him only in recent years.

Henry Parr Hamilton, whose death was announced in last year's Report, was the son of Alexander Hamilton, physician, Professor in the University of Edinburgh, and was descended from an elder branch of the ducal family of the same name. He was born on April 3, 1794, and was educated at the High School, Edinburgh, under Dugald Stewart. He thence proceeded to Trinity College, Cambridge, having been entered on the side of Mr. Young. In the Admission Book of the college, under date October 21, 1811, he gives his native place as Blandfield, Midlothian, and the name of his master as Dr. Baird. He entered the college as a pensioner and was elected scholar in 1814. He graduated as ninth wrangler, in 1816, Whewell being second wrangler, and Richard Sheepshanks tenth wrangler, in the same year. He was elected Fellow of Trinity in 1818, at the same time as Connop Thirlwall and J. C. Hare, and held various college offices from 1819 to 1830: viz., Sub-Lecturer (*i.e.* examiner in the college examinations), 1820, 1821, 1823, 1825; Latin Lecturer, 1824; Head Lecturer (*i.e.* chief examiner), 1830; Junior Dean, 1823–25, Senior Dean, 1825–30. In 1830 he was presented by the Marquis of Ailesbury to the rectory of Wath, near Ripon, where he remained until 1850, when he was appointed Dean of Salisbury, in succession to the Very Rev. Francis Lear. He died at Salisbury on Feb. 7, 1880, aged 86. For the last twenty years of his life his health was very weak, and he seldom appeared in public. The restoration of the Cathedral was, however, a subject of great interest with him to the last. He may be said to

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have been the originator of this work, which was the object of his constant solicitude, and towards which he contributed many thousands of pounds. His kindness of heart and his liberality are widely known; and even in the University he is still remembered for the amiable and courteous manner in which he discharged his duties.

On October 24, 1833, he married Eleanor, eldest daughter of Thomas Mason, Esq., of Copt Hewick Hall, Ripon, who survives him. His only child, Katharine Jane, is married to Sir Edward Hulse, Bart.

In 1826 he published *The Principles of Analytical Geometry designed for the Use of Students in the University*, a book of 320 pp. 8vo., in the Advertisement to which he states that "the work was undertaken with a view of illustrating the importance of Analytical Geometry as a method of investigation," and that his principal end will have been attained if it "shall be the means of attracting the attention of the student to a branch of science which is of extensive utility in the higher departments of mathematics;" and in 1828 he published *An Analytical System of Conic Sections designed for the Use of Students in the University* (pp. 189). In the preface to the latter he explains that the design of the work is to facilitate the study of Conic Sections "upon principles adapted to the present state of mathematical science." Referring to the former work (in which the discussion of the general equation of the second degree preceded that of the parabola, ellipse, and hyperbola), he states that "subsequent experience has taught him that this method of treating Conic Sections, although sanctioned by the practice of very eminent writers on the Continent, is too scientific, if he may use the expression, for elementary instruction." This objection he meets by adopting the focus and directrix definition of the Conic Sections (for which, he states, he is indebted to Boscovich*), and by deducing from it and discussing in separate chapters the equations of the parabola, ellipse, and hyperbola referred to their axes. This work went through five editions: the second was published in 1830, the fourth in 1838, and the fifth in 1843.

There was also a German translation: *H. P. Hamilton's System der Kegelschnitte analytisch dargestellt. Aus dem Englischen übersetzt von J. H. Beuchendorff* (Berlin, 1828). The articles "Analytical Geometry" and "Conic Sections" in the first volume of the *Encyclopædia Metropolitana*, were written by Hamilton; the date of these articles is probably about 1826. He was also the author of the following pamphlets, chiefly relat-

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* The property of the focus, directrix, and determining ratio was known to Pappus. It was first brought fully to light by Sir I. Newton, and used as a definition by Boscovich. It seems to have been first introduced into a Cambridge text-book on Conics by T. Newton, in 1794, in his *Short Treatise on the Conic Sections*: see C. Taylor's *Ancient and Modern Geometry of Conics* (1881), p. lxxi.

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ing to education :—*The Education of the Lower Classes* (1841) ; *A Sermon at Ripon at the triennial Visitation of the Bishop of Ripon, September* 3, 1844 ; *Practical Remarks on Popular Education in England and Wales* (1847) ; *The Church and the Education Question* (1848, and, second edition, 1855) ; *The Privy Council and the National Society* (1850).

Hamilton's work was not the first English treatise on Analytical Geometry, as Lardner's *Algebraic Geometry* was published three years earlier, in 1823, but it was the first Cambridge book, and the first which included Solid Geometry. The first edition of Wood's *Algebra*, which appeared in 1795, contained, as Part IV., a chapter of 30 pages "On the Application of Algebra to Geometry," in which are given the equations of the straight line, ellipse, cissoid, conchoid, the construction of equations, &c. This chapter remained unaltered in the ninth edition (1830), and until the publication of Hamilton's book seems to have formed the only introduction to Analytical Geometry existing in the University. The Senate House papers from 1800 to 1820 show that at the beginning of the century Analytical Geometry was always represented to some extent, though scarcely as an independent subject, most of the questions relating to areas, loci, &c., in which but little more than the mode of representation by means of ordinates and abscissæ was involved. In 1833, Peacock published (anonymously) his *Syllabus of Trigonometry, and the Application of Algebra to Geometry*, seventy pages of which are devoted to Analytical Geometry; there was a second edition in 1836. Hymers's *Conic Sections* appeared in 1837 ; it superseded Hamilton's in the University, and remained the standard work until the publication of Salmon's, Todhunter's, and other textbooks still in use. Hamilton's work, however, was used in schools for years after it had been replaced by Hymers's in the University. Hymers's *Analytical Geometry of Three Dimensions* was published in 1830. The other early English books on Analytical Geometry are *The Elements of Curves* (Anon., Oxford, 1828) and the treatises of Young (1830), Waud (1835), and Wright (1836).

It will thus be seen that the publication of Hamilton's works is of historic importance in connection with the studies of the University, and that they helped onward the great movement started by Herschel, Peacock, and Babbage, for the reform of English mathematics, which at length succeeded in placing Cambridge students in an equal position with those of other European countries. The history of the introduction of the Differential Calculus into the University in place of the Newtonian method of Fluxions is well known and need not be referred to further here; a short account will be found in the biographical notice of Peacock published in the *Monthly Notices*, vol. xix. pp. 125–128 (1859). One sentence from this account may, however, be quoted. Referring to Peacock's Syllabus of Trigonometry and Analytical Geometry, it is remarked that, "the reformers had kept their

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eye too exclusively upon the Differential Calculus, of which this publication was a kind of confession." This seems to be true, and it is to be observed that, although great interest has been displayed in the history of the introduction of the Differential Calculus into the Cambridge examinations, but little attention has been devoted to the gradual growth of Analytical Geometry as a separate subject, which was taking place at about the same time. It is interesting to remark that the reasons which induced Hamilton to recur to the focus and directrix property as a definition still hold good; and that, although there is no doubt that, in a scientific development of the subject, the discussion of the general equation of the second degree should precede that of the particular cases, the subject is rendered much easier for the beginner if the parabola, ellipse, and hyperbola are considered separately immediately after the circle; and the method adopted by Hamilton in his *Conic Sections* has been generally followed in the multitude of text-books which have been published in recent years.

The Royal Astronomical Society had its origin in a meeting of fourteen gentlemen at Freemasons' Tavern on January 12, 1820, and was formally founded on February 8, 1820. Only two months later, on April 14, Hamilton was elected a Fellow, and at the time of his death he was the oldest Fellow of the Society. He thus connected the present time, not only with the revival of mathematics in England, but also with the foundation of the Society. Nearly all his contemporaries who were engaged in similar work near the beginning of the century, Herschel, Peacock, Babbage, Whewell, De Morgan, have passed away and their share in the movement has already been recorded in the pages of the *Monthly Notices.* It may be remarked, however, that the Society still numbers among its Fellows Mr. J. C. Ebden, who was sixth wrangler in Hamilton's year (1816), and was elected a Fellow of the Society only two months later than Hamilton, on June 9, 1820. Hamilton was elected a Fellow of the Royal Society on January 17, 1828; he was also a Fellow of the Royal Society of Edinburgh, and of the Geological Society.

J. W. L. G.

William Augustus Harris was born at Bovey Tracey, in Devonshire, and was educated at Blundell's School, Tiverton. He obtained a Scholarship at Balliol College, Oxford, and was placed in the second class in the Final Examination in Law and Modern History. In 1869 he was called to the English bar, and in 1870 to the American bar. His constant trips to the United States in the years 1871–1877 greatly impaired his health, which completely broke down in 1878. He spent the earlier part of the winter of that year at Davos, and then proceeded to San Remo, whence he returned to England in May 1879 rather worse than better for his residence abroad. In the February following